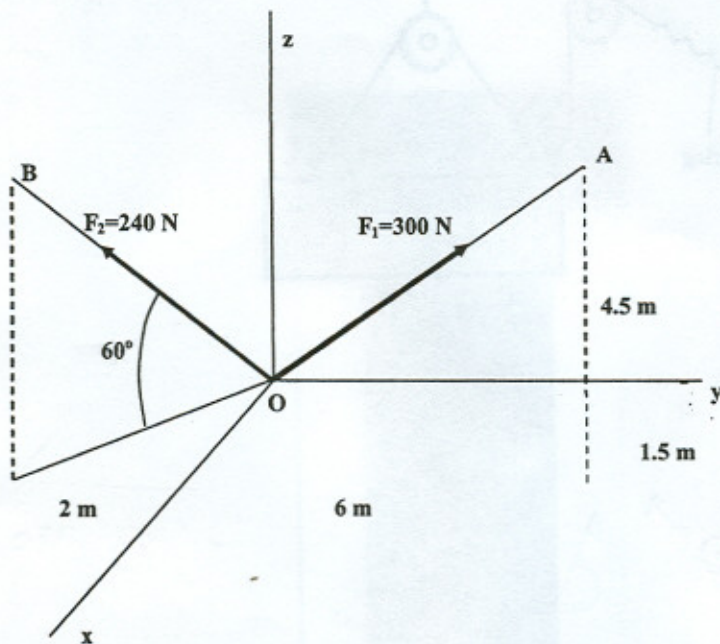
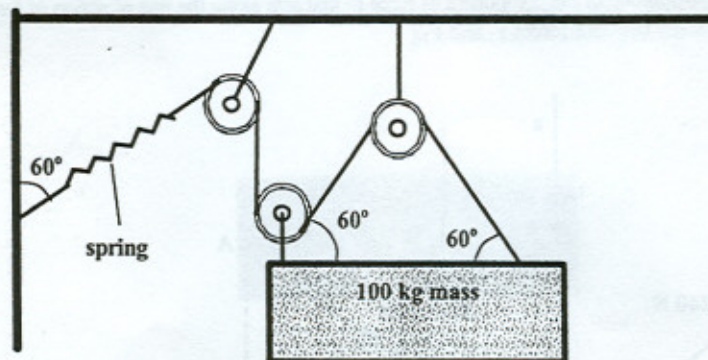


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- 1) Two forces are applied at a point in a body as shown below. Determine:
- The magnitude and direction (expressed by directional cosine angles) of the resultant,  $R$ , of the two forces.
  - The magnitude of the component of force  $F_1$  that acts along the line of action of force  $F_2$ .
  - The angle between forces  $F_1$  and  $F_2$ .



- 2) A mass of 100 kg is supported by the cable and frictionless 3-pulley system shown below. If the spring was 1 m long before being stretched, calculate its final length under the loading shown below. (Spring constant = 10 N/mm)



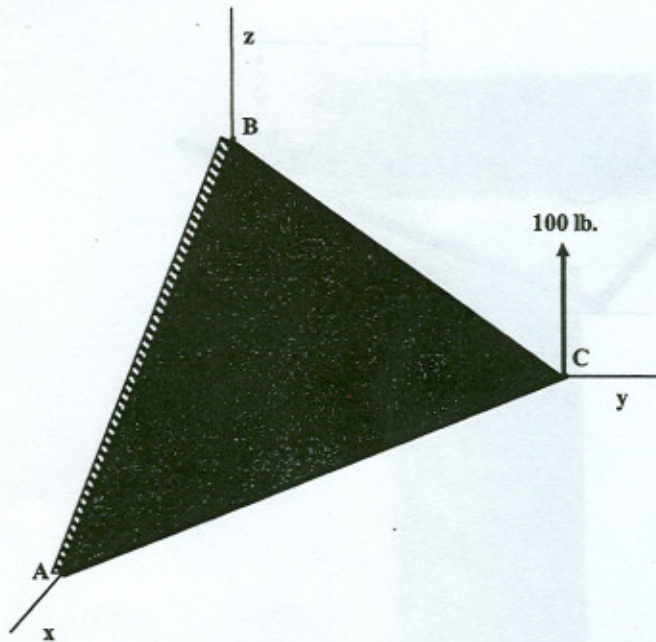
$$\sum F_y = -980 + 3 \sin(60^\circ) T = 0 \quad T = 359.4$$

$$10 \text{ N/mm} = 359.4 \text{ (N)} / (100)$$

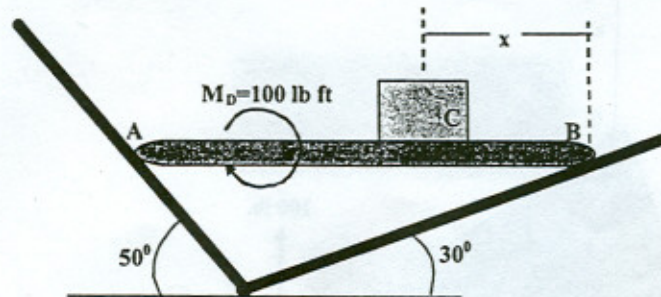
$$35.94 \text{ mm} = x$$

$$1 + 35.94$$

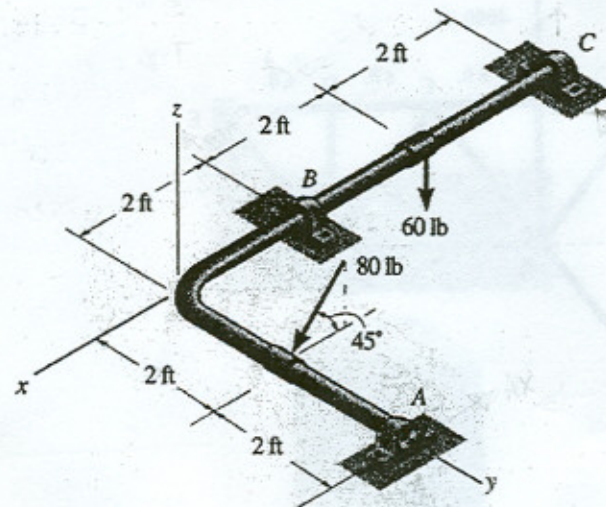
- 3) A triangular shaped lid, ABC, is to be opened along the hinged axis AB by a vertical upward force of 100 lb applied at C. The distances are shown in feet.
- Calculate the magnitude of the moment that the 100 lb force develops about the origin, O, and about the axis AB.
  - Express the above moments as Cartesian vectors.



- 4) The beam AB, supporting Block C and a moment  $M_D$ , rests on frictionless inclines. Determine the distance,  $x$ , that block C is to be located from the right end of the bar for equilibrium to occur. Block C weighs 20 lb and the weight of the bar AB can be neglected. The beam is 10 feet long.



- 5) The rod is supported by journal bearings at A, B, and C. Determine the x, y, and z components of the reactions at these supports due to the loading shown. The bearings are in proper alignment and exert only force reactions on the rod.



$A_x = 56.56$   
 $A_y = 0$   
 $A_z = 0$

$$\sum M_A = 0 \Rightarrow B_z(4) + A_z(8) - 80(2) = 0$$

$$\sum M_B = 0 \Rightarrow A_x(4) - 80(2) + 4(A_z) = 0$$

$$\sum M_C = 0 \Rightarrow -80(8) + 4(A_x) = 0$$

$$\sum F_x = 0$$

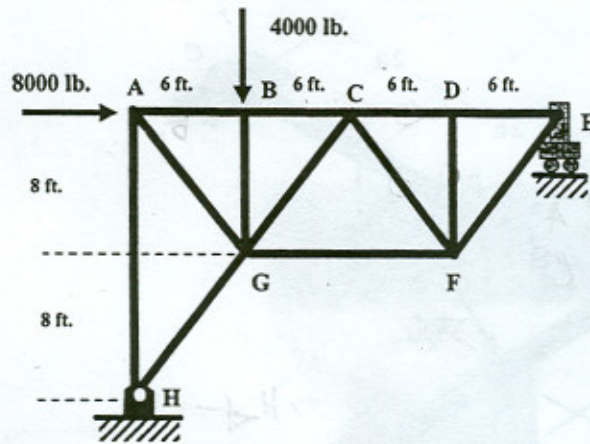
$$A_x = 56.56 \text{ lb}$$

$$M_{ox} = 2(80)(\cos 45^\circ) - 2(80)(\sin 45^\circ) + 4(80) + 4(A_z)$$

$$-2(80) + 113.137 = 0 \Rightarrow 113.137 = 2(80) + 4(A_z)$$

$$113.137 = 160 + 4(A_z) \Rightarrow 226.274 = 4(A_z) \Rightarrow A_z = 56.5685$$

- 6) Find the forces in members CD, CF, GF and DF in the truss shown below. The truss is supported by a pin at H and a roller at E.



$$H_x = 8000 \text{ lb}$$

$$\sum M_G = 0 = H_y(24) - 4000(12) - 8000(16) = -20333$$

$$24 H_y = 20333$$

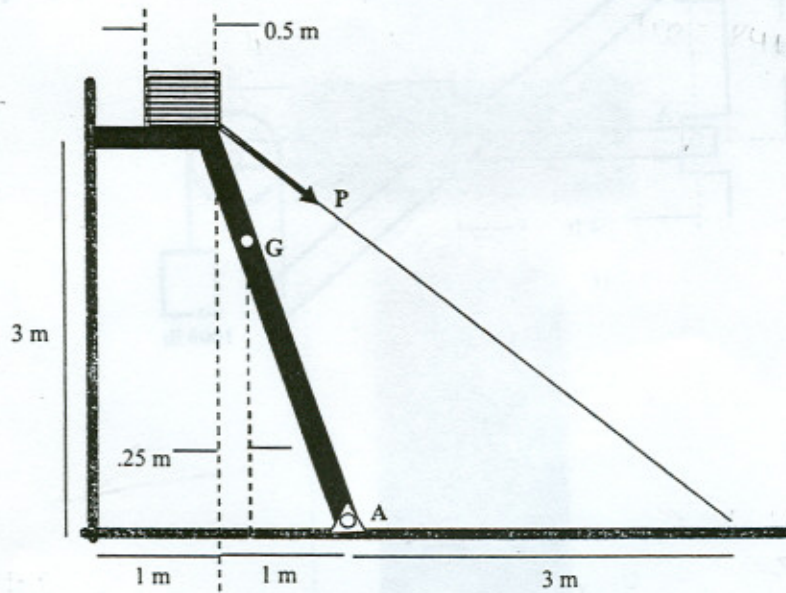
$$H_y = 7333$$

$$\sum M_H = 0 = 4000(12) - 8000(16) - 24 H_y = -20333$$

$$24 H_y =$$

$$20333$$

- 7) Temporary scaffolding is placed against the wall of a building as shown below. A rope is attached to the corner of a uniform box sitting on top of the scaffolding. The scaffolding is pinned to the floor at A. What force  $P$  is required to cause motion. ( $\mu_s = 0.4$ ). Assume that the scaffolding is a single rigid body. The weight of the box is 300 N. The weight of the scaffolding is 500 N. The center of gravity of the scaffolding is shown as G.



- 8) The frame shown below is loaded by a force of 1000 lb. Calculate the magnitude and direction of the resultant reaction force at A and at C, acting on member AD. The pulley has a radius of 1 foot.

